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A systematic review of verb production training in agrammatic Broca's aphasia

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ABSTRACT

Aims: This systematic review investigates the effectiveness of verb production training in individuals with agrammatic Broca's aphasia. It highlights verb retrieval and verb inflection treatments, evaluating their impact on naming accuracy, sentence production, and generalization. The ultimate goal of the present study is to systematically review and evaluate the effectiveness of verb production training methods—including both verb retrieval and verb inflection interventions—for improving communication outcomes in patients with agrammatic Broca's aphasia.

Methods: This review followed the PRISMA 2020 guidelines. Four databases (PubMed, Medline/EBSCOhost, Web of Science, and Google Scholar) were searched using PICO-based terms. Inclusion criteria consisted of peer-reviewed articles in English which exclusively focused on verb production training in agrammatic Broca's aphasia with measurable outcomes. Exclusion criteria included studies on other aphasia types, non-intervention papers, and non-English or unavailable full texts. After removing duplicates and screening 1461 records, ten studies met the eligibility criteria.

Results: Of the ten studies included, six focused on verb retrieval treatments and four on verb inflection treatment. Interventions varied widely, including semantic, gestural, and repetition-based methods for verb retrieval and morphosemantic and morphophonological treatments for verb inflection. While verb retrieval treatments improved naming of trained verbs, generalization to untrained items was inconsistent. Morphosemantic approaches to verb inflection outperformed morphophonological treatments and had broader generalization and improvements in narrative tasks, particularly with regular verb training. Overall, participant response varied depending on the nature of the impairment and treatment modality.

Conclusion: Verb production training is effective in improving targeted linguistic abilities in agrammatic Broca's aphasia, particularly when approaches are tailored to individual deficits. Morphosemantic and multimodal interventions demonstrate promising results. However, limited generalization to untrained contexts remains a key challenge, highlighting the need for future therapies that integrate semantic, syntactic, and real-life communicative components.

Keywords: Broca's aphasia, verb production, the PRISMA 2020, language disorders, aphasia treatment

INTRODUCTION

Systematic reviews are comprehensive summaries of original research that are aimed at a specific research question.[1] They aim to find, select, synthesize, and critically evaluate all high-quality evidence pertinent to that question. The importance of writing a systematic review article, particularly in medicine, lies in its ability to provide a high-level synthesis of existing research.[2] Verb production is crucial for effective communication, particularly in individuals with agrammatic Broca's aphasia, as it significantly impacts their ability to construct meaningful sentences. Effective verb production training can enhance communication skills in these individuals, potentially improving their overall quality of life and social interactions.[3] Research indicates that targeted verb production training can lead to significant improvements in sentence construction for individuals with agrammatic Broca's aphasia, enhancing both communication and quality of life and providing a pathway for better integration into social contexts. This training not only addresses verb retrieval deficits but also promotes generalization to broader language use in daily life.[4] Verbs are central to sentence construction and communication, yet they are disproportionately influenced in agrammatic Broca's aphasia.[5] Synthesizing evidence from existing research can provide insights into the effectiveness of various interventions, help identify best practices and highlight gaps in the recent research. This accumulated knowledge can guide clinicians in developing targeted therapies, ultimately improving language outcomes and quality of life for patients with this agrammatic Broca's aphasia.

Aphasia is a language disorder bought on by the damage to the brain's language centres which is located in the dominant

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hemisphere, mostly the left.[6] Language impairment is characterized by challenges with comprehension, written or verbal expression, or both. There are multiple types of aphasia, clinically the most common ones of which include Broca's aphasia (expressive) and Wernicke's aphasia (receptive), global aphasia, conduction aphasia, transcortical motor aphasia, transcortical sensory aphasia, mixed transcortical aphasia, and primary progressive aphasia as well as the other types including crossed aphasia, anomia (nominal aphasia or anomic aphasia), and subcortical aphasia.[7] Broca's aphasia, specifically agrammatic Broca's aphasia, constitutes a constellation of language symptoms resulting from brain lesion in Broca's area and damage to the left hemisphere's peri-Sylvian regions.[5]

The primary feature of agrammatic Broca's aphasia is the markedly deficient production of sentences: utterances are composed of words assembled in an ungrammatical sequence, or, simplistic canonical sentence structures (e.g., subject-verb-object, in English).[8,9] Additional characteristics associated with agrammatic aphasia encompass difficulty with verbs (both in sentence and in single word retrieval) as well as with grammatical morphemes (including both free morphemes and inflectional forms).[10] Moreover, individuals exhibiting agrammatic speech production might also demonstrate asyntactic comprehension.[11] This phenomenon pertains to the difficulty in comprehension of syntactically intricate sentences (such as passive constructions and object relatives), especially in contexts that are semantically reversible. While impairment in sentence production serves as the defining feature of agrammatic aphasia, there exists substantial variability in individuals regarding the severity of deficits.[11,12]

Individuals with agrammatic Broca's aphasia often experience significant challenges in verb production, particularly characterized by verb inflection and verb retrieval, which has been reported in various languages (Dutch,[13] Italian,[14] English,[15] Persian,[16] and Turkish[17]). These impairments can severely influence sentence construction and hinder effective communication.[18] Moreover, these patients frequently omit or substitute verbs in their speech, leading to a reliance on nouns and other simpler structures, which further complicates their ability to convey meaning effectively. These challenges highlight the complex interplay between syntactic and morphological deficits in agrammatic Broca's aphasia, as verb production issues can impact broader grammatical structures.[19] In particular, the production of verbs is often more severely affected than that of nouns, resulting in a noticeable dissociation in spontaneous speech.[16,20] This pattern underscores the need for targeted therapeutic interventions to address these specific verb production deficits. Research indicates that verb production impairments in agrammatic Broca's aphasia are often linked to difficulties in accessing verb word forms and verb meanings, which can adversely affect overall communication effectiveness. These challenges necessitate focused treatment approaches to enhance verb retrieval and production skills in affected individuals.

The goal of this study is to present a systematic review of the role of verb production trainings on agrammatic Broca's aphasia. This study was needed to provide a comprehensive synthesis of the existing intervention studies on verb production training in agrammatic Broca's aphasia, as there is currently no systematic review summarizing the targeted treatments and their outcomes for this particular group of patients. By consolidating the available evidence, this review aims to identify effective intervention methods, reveal methodological limitations in the existing literature, and inform future research directions and clinical practices.

METHODS

Ethics

The study was carried out without involvement of any animate beings. Hence, an ethics committee approval was not required. All steps were carried out in conformity with the ethical guidelines and principles outlined in the Declaration of Helsinki.

In this study, the Preferred Reporting Items for Systematic Reviews and Meta Analysis (PRISMA) guideline was utilized. The PRISMA 2020 is a systematic review guideline aimed at enhancing the transparency and quality of reporting in systematic reviews. The PRISMA statement was first published in 2009.[2] As systematic review methodology and terminology has advanced over the past two decades, an update to the guideline has become essential. Thus, the 2009 statement was superseded by the PRISMA 2020. The PRISMA 2020 introduces several key modifications as compared to the original 2009 guideline. The new guidelines comprised the following changes: an expanded checklist (a 27-item checklist that includes reporting requirements for each item), revised flow of diagrams, and enhanced terminology and methodology.[21]

Search Strategy

This study involved searching the following 4 electronic databases: PubMed, EBSCOhost (Medline), Google Scholar, and Web of Science (core collection). The comprehensive search included all records available from the inception of each database up to January 10, 2025, which marks the date of the final search.

The search strategy required searching the databases for the 4 concepts generated from the PICO framework. The PICO framework is the most widely used model for organizing clinical enquiries since it includes every essential component needed for a focused question.[22] In the PICO framework, within the scope of the present study, p (study population) represents patients with agrammatic Broca's aphasia, i (intervention) is the use of verb production training or therapy, c (comparison) addresses to various verb types, and o (outcome) is the indicators of performance as a consequence of training or therapy. The concepts were searched using MeSH (Medical Subject Headings) terms, keywords and their related terms. For further relevant studies, the reference lists of the selected articles were also examined. The Boolean operator "AND" was utilized to search the concepts of the PICO framework elements. A variety of string combinations were used in different databases in order to have access to more relevant articles. **Table 1** below illustrates the database search strings.

Table 1. The database search strings

No.	Database searched	Search strings
1	PubMed	((Agrammatic Broca's aphasia) and (verb production)) AND (verb therapy) (Agrammatic Broca's aphasia) AND (verb therapy) (Agrammatic aphasia) AND (verb production training) ((Agrammatic aphasia) AND (speech therapy)) AND (verb production) (Agrammatic aphasia) AND (verb therapy)
2	EBSCOhost (Medline)	Agrammatic Broca's aphasia AND verb production AND training Agrammatic aphasia AND verb production AND training Agrammatic aphasia AND speech therapy AND verb production Agrammatic aphasia AND verb therapy Agrammatic Broca's aphasia AND verb therapy
3	Web of Science (core collection)	Agrammatic Broca's aphasia (all fields) AND verb therapy (all fields) Agrammatic aphasia (all fields) AND verb therapy (all fields) Agrammatic Broca's aphasia (all fields) AND verb production training (all fields) Agrammatic aphasia (all fields) AND verb production training (all fields) Agrammatic aphasia (all fields) AND speech therapy (all fields) AND verb production
4	Google Scholar	"Agrammatic Broca's aphasia" AND "verb therapy" "Agrammatic Broca's aphasia" AND "verb production" AND "training" "Agrammatic aphasia" AND "verb therapy" "Agrammatic aphasia" AND "verb production" AND training "Agrammatic aphasia" AND "speech therapy" AND "verb production"

AND: The Boolean operator

Inclusion/Exclusion Criteria

This systematic review included (1) peer-reviewed studies published in English from beginning to the 10 January 2025, (2) studies focusing on individuals diagnosed with agrammatic Broca's aphasia, (3) studies investigating the effects of verb production training interventions, such as verb retrieval therapy, action naming tasks, or sentence construction exercises, (4) studies reporting measurable outcomes related to verb production, including improvements in fluency, accuracy, or sentence complexity, and (5) studies providing clear descriptions of the intervention methods, including details about duration, frequency, and delivery.

Studies excluded from this systematic review were (1) those that did not focus on agrammatic Broca's aphasia or did not involve verb production training as the primary intervention, (2) studies without measurable outcomes or with insufficient details regarding the intervention effects, (3) conference proceedings, thesis or dissertations, posters, reviews, case reports, editorial letters, or commentaries, (4) studies employing interventions unrelated to verb production training, such as general cognitive rehabilitation or therapies not targeting verb usage, and (5) studies published in languages other than English or without full-text availability.

Data Extraction

For the purpose of data extraction, the title and abstract of the studies gathered through the search step were screened and thus irrelevant articles were excluded. A full-text examination was performed to determine the eligibility of the articles to be included in the systematic review. Overall, the PRISMA 2020 guideline was followed to retrieve data based on study characteristics.

RESULTS

The initial database search strategy yielded a total of 1461 results, which is listed as follows: PubMed (n=116), Medline EBSCOhost (n=57), Google Scholar (n=1100), and Web of Science (n=188) as illustrated in **Figure** below. A total of 672 duplicates were identified and removed. The rest underwent a title and abstract screening. A total of 756 articles were excluded as a consequence of the screening process due to several reasons with the majority of the studies being excluded for focusing on other types of aphasia such as primary progressive aphasia or other diseases such as Alzheimer's, not investigating verb production, being published in languages other than English, etc.

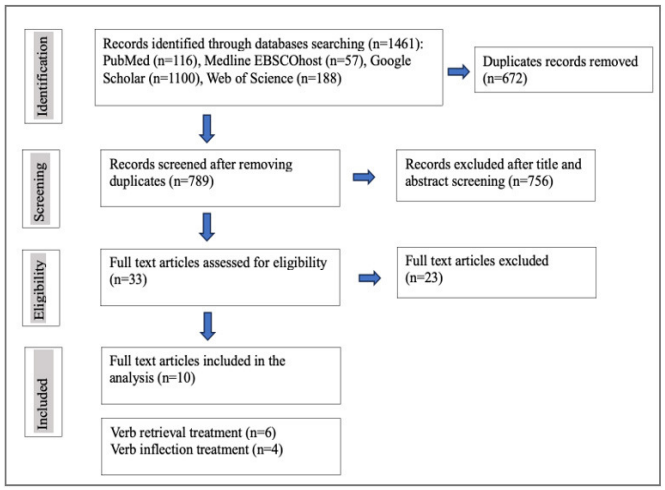
Identification
Records identified through databases searching (n=1461): PubMed (n=116), Medline EBSCOhost (n=57), Google Scholar (n=1100), Web of Science (n=188)
Duplicates records removed (n=672)
Screening
Records screened after removing duplicates (n=789)
Records excluded after title and abstract screening (n=756)
Eligibility
Full text articles assessed for eligibility (n=33)
Full text articles excluded (n=23)
Included
Full text articles included in the analysis (n=10)
Verb retrieval treatment (n=6)
Verb inflection treatment (n=4)

Figure. Study selection process (flow chart diagram)

The remaining 33 studies went through full-text article examination and a total of 23 studies were excluded as they did not particularly focus on agrammatic Broca's aphasia, but they were conducted with patients with other types of aphasia, they were either dissertations, book chapters, or poster presentations, they were review articles on verb production with a variety of aphasia patients, full text was not available or published in another language. More precisely, there were 8 studies which were excluded as they were not articles but either dissertations, book or book chapters, and poster. Furthermore, there were 7 articles which were excluded for focusing on other types of aphasia such as Wernicke's aphasia, transcortical motor aphasia, etc. In total, there were 3 review

articles excluded from the present study, and there were 2 articles, the full texts of which were not available. Lastly, there was one study, which was a previous version of Dashti et al.[23] and the patients were also included in this later study. Therefore, the prior study was excluded to avoid repetition in the analysis.

Up till 10 January 2025, a total of ten articles published in peer-reviewed publications matched the eligibility criteria, in which the effects of verb production training were investigated with patients who had agrammatic Broca's aphasia (**Figure**).

Study Characteristics

Among the 10 studies included in this systematic review, there were 6 studies conducted in the USA, 2 in Iran and 2 in Australia. All of the studies recruited patients only with agrammatic Broca's aphasia. The total number of the patients from the studies included was 35, and the overall age of the participants was 54.71. The main patient characteristics are given in **Table 2**.

In this systematic review, there were 6 studies which particularly focused on verb retrieval/verb naming treatment, and there were 4 studies which examined the effect of treatment approaches on verb inflection, particularly tense marking (regular and irregular verbs). The studies on verb retrieval employed a variety of intervention methods such as semantic treatment, gesture treatment, combined semantic and gesture treatment, repetition treatment, and other treatments such as verb naming, low concreteness, and verb class treatments. On the other hand, verb inflection treatments mainly included morphosemantic treatment. One study provided a comparison between morphosemantic and morphophonological treatments,[24] and there was one study which employed the ACTION treatment adapted to Persian.[16] **Table 3** below summarizes the intervention methods employed in each study and key findings.

Further minutes of the results are provided below under two subheadings: (i) verb retrieval treatment and (ii) verb inflection treatment.

Verb Retrieval Treatment

Verb retrieval impairments are a hallmark deficit in aphasia, which results in problems with sentence production and communication.[25] This review synthesizes findings from the six intervention studies that explore diverse approaches to enhance verb production in individuals with agrammatic Broca's aphasia.

Across studies, a common theme is the targeting of verb semantics and its association with broader linguistic structures. To start with, one study focused on enhancing verb retrieval by explicitly training verb-noun argument structures.[26] This approach led to improved verb naming and some sentence production gains, particularly when verbs had strong semantic links to noun arguments. Researchers also explored class-based semantic training, aiming to generalize effects across semantically related verb groups, though generalization remained elusive.[27] Multi-modal strategies were tested by incorporating semantic feature analysis, gesture, and repetition.[3,28,29] These studies emphasized that treatment effects vary by the nature of the verb deficit: individuals with word-form impairments showed more robust improvements than those with semantic-level deficits. More precisely, these studies highlighted the potential additive benefit of combining semantic and gestural cues. They reinforced the variability in individual response, finding all three modalities (semantic, repetition, gesture) yielded improvements in verb naming, as well as gains which allows generalization to narrative and conversation tasks. A novel focus was offered on abstract, low-concreteness verbs using sentence completion probes rather than pictorial stimuli.[25] Although treatment effects were modest, the study remains crucial as it demonstrates the feasibility of treating abstract verbs, which are vital for functional communication but often neglected due to methodological constraints.

A consistent finding across all six studies is the efficacy of intervention on trained items. Regardless of the modality, participants generally showed improvement in naming targeted verbs. However, generalization to untrained items or other communication tasks remains a challenge. Studies involving semantic training with higher cognitive demands tended to show less generalization, possibly due to the lack of overlapping semantic networks in training stimuli. The impact of treatment modality also varied: while gesture was hypothesized to enhance verb retrieval due to its alignment with action concepts, its superiority was not consistently

Table 2. Participant characteristics of the studies included in this systematic review

No.	Author(s), year	Country	Participants (n)			Age (years)		
			Total (n=XXX)	BA (n=XXX)	Non-BA (n=XXX)	Overall age	BA	Non-BA
1	Faroqi-Shah (2008)	USA	4	4	NA	64.5	64.5	NA
2	Kim, Adingono, & Revoir (2007)	USA	2	2	NA	45.5	45.5	NA
3	Rose (2010)	USA	5	5	NA	54.6	54.6	NA
4	Bailey, Bunker, & Wambaugh (2024)	USA	3	3	NA	50	50	NA
5	Dashti, Asadi, & Yadegari (2023)	Iran	4	4	NA	53.75	53.75	NA
6	Faroqi-Shah (2013)	USA	6	6	NA	54.5	54.5	NA
7	Rose & Sussmilch (2008)	Australia	3	3	NA	51	51	NA
8	Boo & Rose (2010)	Australia	2	2	NA	60	60	NA
9	Faroqi-Shah & Graham (2010)	USA	2	2	NA	54.5	54.5	NA
10	Valinejad et al. (2024)	Iran	4	4	NA	58.75	58.75	NA

NA: Not applicable, BA: Broca's aphasia, Non-BA: Without Broca's aphasia

Table 3. General study characteristics of the studies included in this systematic review

No.	Author(s), Year	Intervention	Key findings
1	Faroqi-Shah (2008)	Morphophonological treatment; morphosemantic treatment	Significant improvement in verb inflection with morphosemantic treatment; No accuracy improvement with morphophonological treatment
2	Kim, Adingono, & Revoir (2007)	Verb naming treatment; baseline procedures; generalization to sentence production; maintenance and posttreatment testing; control tasks	Improvement in verb retrieval and sentence production; Variability in generalization levels; Potential for enhanced language performance
3	Rose (2010)	Semantic treatment; repetition treatment; combined gesture and semantic treatment; gesture alone treatment	Improvement in verb retrieval on trained items; Variable response to treatment conditions; No superiority of one treatment over another; Limited generalization to untrained contexts
4	Bailey, Bunker, & Wambaugh (2024)	Behavioral treatment to improve low concreteness in verb naming; randomized stimuli order; audio recording	Limited changes in verb production; Modest decreases in aphasia severity; Variability in treatment response
5	Dashti, Asadi, & Yadegari (2023)	Morphosemantic treatment; verbal feedback	Effectiveness of morphosemantic treatment; Significant improvement in verb inflection; Generalization and maintenance of treatment effects; Improvement in narrative measures and language tests scores
6	Faroqi-Shah (2013)	Morphosemantic treatment; training with regular and irregular verbs	Improvement in trained tenses; Generalization to untrained verbs, esp. for regular past; Potential for rule-based morphology improvement
7	Rose & Sussmilch (2008)	Semantic treatment; gesture treatment; combined semantic plus gesture treatment; repetition-only treatment	Effectiveness of treatments on verb retrieval; Variability in treatment response; Generalization and use of treated items in picture description and conversation tasks
8	Boo & Rose (2010)	Semantic treatment; gesture treatment; combined semantic and gesture treatment repetition-only treatment	Improvement in verb naming accuracy; Variability in treatment response; Efficacy across different modalities; Generalization to narrative and conversation tasks
9	Faroqi-Shah & Graham (2010)	Verb class treatment; generation and analysis of semantic features; semantic feature analysis (SFA); sentence generation; use of videos	Improvement in verb retrieval; Limited generalization effects; Variability in treatment response
10	Valinejad et al. (2024)	Persian ACTION treatment	Effectiveness of verb tense inflection treatment; Generalization to untrained items, esp. for regular verbs; Improvement in narrative scores

demonstrated across participants. Nevertheless, participant-specific factors, such as type of deficit (semantic vs. word-form), severity of aphasia, and cognitive abilities, were stronger predictors of treatment success.

The reviewed studies collectively suggest that verb retrieval treatments are effective for improving naming of trained verbs, particularly when tailored to individual deficit profiles. Approaches combining semantic elaboration and gesture may offer added value for those with phonological access impairments. However, generalization to untrained items and functional discourse remains limited, underscoring the need for further development of treatments that integrate real-world communicative contexts and semantic network reinforcement.

Verb Inflection Treatment

People with agrammatic aphasia typically have trouble producing verb morphology, particularly tense inflection. This review synthesizes evidence from four treatment studies targeting verb inflection impairments, focusing on morphophonological and morphosemantic interventions, with particular attention to the effects on regular and irregular verb forms across English and Persian speakers.

Two principal theoretical models underlie the interventions: morphophonological approaches, emphasizing affixation and phonological encoding, and morphosemantic strategies, which embed tense marking within semantically driven sentence contexts.[24,30] Studies consistently show that morphosemantic approaches yield greater improvements in functional communication, supporting the notion that sentence-level processing deficits, rather than isolated word-form errors, underpin tense inflection impairments in agrammatic aphasia. A comparison of these two models was offered in one of the earliest studies. They found that morphosemantic treatments enhanced both trained and untrained verb inflection production within sentence contexts, whereas morphophonological training improved the variety of inflected forms but not their accuracy or syntactic deployment.[24] In line with this, another study demonstrated that morphosemantic treatment led to significant improvements in both regular and irregular tense marking across past, present, and future tenses in Persian, with generalization to untrained verbs and enhanced narrative measures.[30] Therefore, this suggests cross-linguistic efficacy and transferability of morphosemantic strategies, particularly when embedded in communicative tasks. A nuanced comparison emerges when differentiating between regular and irregular verb training. It was reported that training with irregular verbs led to broader generalization, including to regular verb forms, likely due to activation of rule-based mechanisms (e.g., the default +ed rule in English).[31] In contrast, training regular verbs showed limited generalization to irregulars, consistent with theories positing distinct lexical storage for irregular forms. Similar findings were obtained in one of the latest studies which was extended to Persian using the adapted ACTION protocol.[16]

All participants improved on trained tenses, with better generalization for regular verbs. Sentence construction scores also improved, highlighting the integration of morphological learning into syntactic processing.

Across languages and paradigms, morphosemantic treatments outperform morphophonological approaches in improving verb inflection deficits in agrammatic Broca's aphasia. Treatments that embed inflection within sentence-level contexts, especially those involving semantic and syntactic mapping (e.g., ACTION), foster broader generalization, functional gains, and narrative improvements. Additionally, irregular verb training appears more potent in promoting generalization due to its dual activation of lexical and rule-based mechanisms. Future treatments should consider the integration of morphosemantic cues and emphasize sentence-level contexts to optimize clinical outcomes.

DISCUSSION

The results of this systematic review offer promising evidence for the use of verb production training in individuals with agrammatic Broca's aphasia. A key favorable finding is that all studies targeting verb retrieval reported improved performance on trained items, suggesting that these interventions can lead to specific gains in lexical access. Semantic feature analysis, gesture-supported approaches, and repetition-based treatments were especially effective when aligned with the patient's individual impairment profile. Similarly, morphosemantic interventions for verb inflection consistently led to significant improvements in tense marking and sentence-level production, often extending to narrative tasks and generalization to untrained verbs. Nevertheless, the review also highlights some less favorable aspects. Despite gains on trained items, generalization to untrained verbs or spontaneous speech remained limited in most studies. This suggests that while interventions can be effective at improving task-specific performance, they often fail in promoting functional communication gains beyond the clinical setting. Additionally, individual variability in treatment response was substantial, for instance, with some participants benefiting more from gestural cues and others from semantic elaboration. This variability complicates efforts to standardize therapy protocols and reflects the complex and heterogeneous nature of aphasic impairments. Furthermore, the small sample sizes and methodological diversity reduce the strength of generalizable conclusions, indicating the need for larger, well-controlled trials with more consistent outcome measures.

In conclusion, this review confirms that verb production training, especially when grounded in morphosemantic principles and supported by multimodal strategies, is a valuable approach for improving language performance in agrammatic Broca's aphasia. The most effective treatments appear to be those that incorporate sentence-level or discourse-level processing, allowing patients to reintegrate verbs into broader grammatical structures. Nevertheless, challenges related to generalization, individual variability, and methodological inconsistency remain. Future research should aim to develop more ecologically valid interventions that target real-life communicative contexts and investigate long-term maintenance of treatment effects.

Limitations

This systematic review is limited to a small number of eligible studies and relatively small sample sizes within them, which might affect the generalizability of the findings. In other words, the search strategy was limited to specific academic databases and studies with accessible full texts in English, thereby excluding potentially relevant research not indexed in these sources or unavailable in full, which may have narrowed the overall evidence base. Additionally, the limited number of studies dedicated specifically to verb production training in agrammatic Broca's aphasia suggests a broader issue in the field—namely, that this area remains underexplored. The scarcity of targeted intervention research highlights the need for more empirical work in this domain to support evidence-based clinical practice.

CONCLUSION

This review revealed that verb retrieval training in individuals with agrammatic Broca's aphasia led to significant improvements in the production of trained verbs. Interventions using semantic feature analysis, gestural support, and repetition-based strategies showed promising results. Nevertheless, these gains were largely limited to practiced items, with generalization to untrained verbs or spontaneous speech remaining inconsistent. Treatment outcomes varied depending on individual language profiles and the nature of the underlying impairment. In terms of verb inflection, morphosemantic approaches, which embed tense marking within meaningful sentence contexts, were more effective as compared to morphophonological methods. These treatments not only enhanced the accuracy of tense marking but also demonstrated better generalization to untrained items and narrative tasks. Cross-linguistic findings, including studies in English and Persian, supported the robustness of morphosemantic strategies, particularly when aligned with rule-based and communicative frameworks.

In conclusion, the findings support the effectiveness of targeted verb production training for agrammatic Broca's aphasia, especially when individualized and integrated with sentence-level or discourse-based contexts. While both verb retrieval and inflection can be improved through specific interventions, the persistent challenge of limited generalization highlights the need for future treatments that better bridge trained skills with real-life communication demands.

ETHICAL DECLARATIONS

Ethics Committee Approval

The study was carried out without involvement of any animate beings. Hence, an ethics committee approval was not required.

Informed Consent

Since the study was conducted without the participation of any living beings, informed consent is not required.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement
The authors have no conflicts of interest to declare.

Financial Disclosure
The authors declared that this study has received no financial support.

Author Contributions
All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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